

VIII. Window into Forestry and Wildlife



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8.1 Introduction

Out the window of our building we spy, in the distance, a lovely forest. We might see that forest as a resource for lumber or forest products necessary to build the structures we live in. We might see it as a place to walk and enjoy the outdoors. We could see it as a place in which to hunt for recreation and sustenance. We could know that it is cleansing the air and helping to purify our water. All of these views of forests and the wildlife contained are accurate. Whatever our view of forests – whether from the economic value they hold, the recreation they provide, or the beauty they possess – Virginia's forests are an important renewable resource.

Objectives

In this lesson students will:

- Differentiate forests from other biomes
- Describe features of the temperate deciduous forest biome
- Compare the change in the composition of forests over the past few years
- Link forest ecosystems with other life-cycles (water, carbon, and nutrient cycles)
- Discuss factors that cause deforestation, and the consequences of each factor
- Think of preventive actions for deforestation, and how they can be implemented
- Identify causes of wildfires in forests and discuss effects of fire
- Examine types of wildlife commonly found in Virginia
- Explain ways homeowners can create wildlife friendly habitats

SOLs

Science 6.9, English 6.2

Key Terms/ Concepts

- Habitat
- Biodiversity
- Deforestation
- Tropical
- Temperate
- Endangered
- Sustainability
- Erosion
- Biome



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8.2 Student Information

Forests benefit people in many ways. Their resources allow us to build shelter, enjoy recreation, purify water and air, and sustain wildlife. Forests provide a unique ecosystem home to a variety of plant and animal species. The economic value of a forest is not just in the amount of lumber one can harvest, but also in the biodiversity and environmental benefits it provides. Following are some of the important services that forests provide (also see Table 1– Important Services that Forests Provide):

- **Biodiversity** – Provides habitats for a variety of plant and animal species. Makes the ecosystem more resilient to disturbance.
- **Water Storage** – Rainwater is absorbed by forests and stored in plants that slowly release it back into the environment, reducing runoff and erosion.
- **Fisheries** – Forests protect fisheries by filtering water, lowering water temperature, and providing habitat for fish.
- **Climate** – The world's climate is stabilized by forests using and storing gases from the atmosphere. Some gases can cause global warming if released.
- **Recreation** – Humans use forests for recreation such as wildlife observation, fishing, hiking, camping, and hunting.
- **Commercial** – Timber is taken from forests for use in construction and industry.

Deforestation reduces these services. Deforestation can be defined as the permanent removal of trees from an area. Examples of deforestation are removal of trees for agriculture or for residential/commercial development. Cutting trees does not result in deforestation unless the land is converted to other uses.

In Virginia, 62 percent of the state is forested. Much of our loss of forests is due to urbanization and development. Educating people is key to managing deforestation. The Virginia Department of Forestry has developed Best Management Practices (BMPs) as guidelines for proper timber harvesting. Though not required by law, BMPs are a helpful strategy.



Today, the national forest system maintains 191 million acres. These forests are managed through fire policies, timber harvesting, wilderness designations, and wildlife habitat and watershed protection. Forest ecosystems are linked with other life cycles including the carbon, nitrogen, and water cycles.

- **Carbon Cycle** – Carbon is extracted by living things from their nonliving environment. Forests also reduce carbon dioxide from accumulating in the atmosphere and increasing global warming.
- **Nitrogen Cycle** – Plants absorb nitrates, which prevent excess buildup in the soil. Excess nitrates in groundwater can make it unsafe to drink.
- **Hydrological (Water) Cycle** – Forests regulate the amount of water entering rivers, oceans, and streams by capturing water in their roots, trunk and leaves. They control evaporation rates, helping to regulate weather and climates.

Natural wildfires are a serious threat in many areas of the world. We have done a good job of preventing human-caused forest fires. Some fire is necessary in order to prevent larger fires from happening.

There are three types of fires:

- **Ground Fire** – Burns at the bottom of the forest and on the ground. These fires are not a large threat to humans, but are very difficult to extinguish. They help prevent crown fires.
- **Surface Fire** – Burns in shrubs and other vegetation low to the ground.
- **Crown Fire** – Burns at the tops of trees. These are the most dangerous and cause the most damage.

Fish and wildlife are an important part of the forest ecosystem. Deforestation and river pollution threaten the sustainability of fish and wildlife. Wildlife refuges provide habitat for endangered species. There are ways to promote wildlife around your own home, including diversity of plant species, providing food during all seasons, varieties of plant colors, and clean fresh water.



Table 1:
Important
Services that
Forests Provide

Biodiversity

Forests contain within them a variety of plant and animal species, habitats, and genes that haven't all been discovered. They provide the gene pool that can protect commercial plant strains against pests and changing conditions of climate and soil and can produce raw material for breeding higher-yielding strains. Some believe forests may contain undiscovered species of plants (herbs) that with future research may be medicine for fatal diseases such as cancer and AIDS. These potential medicines would be lost to humanity if the current trend of deforestation continues.

Water Storage

Rainwater is absorbed by forests, where it is stored in plants and is slowly released back into the environment. This prevents flooding and also saves the soil since flooding would lead to erosion. This is especially beneficial since erosion usually washes away the top soil which contains most of the nutrients so once excessive erosion takes place, the soil is left infertile and plants can no longer be grown on that land. Then by storing the water, forests also conserve water for drier months when it will be needed.

Fisheries

Forests protect fisheries because some fish are nurtured in seasonally flooded forests where they feed on plants and various fruits, while others depend on natural, old-growth forests for their viability. So in essence, forests support fish life and contribute to sustainability since over-fishing is such a huge problem in our world today.

Climate

Climate is stabilized by forests because they act as carbon sequestration sinks by absorbing carbon dioxide in photosynthesis, and it would be extremely costly to replace this biome's role in storing of the gas carbon dioxide. They also store other gases such as methane and nitrous oxide in different biological processes, thereby controlling their release into the atmosphere. Water that flows through forests and moves through plants through transpiration also helps regulate climate by cooling the air and ensuring the proper amount of precipitation.

Recreation

Activities such as wildlife observation, fishing, and hiking are among the many recreational benefits that people can obtain from forests.

Commercial

Wood products are used extensively by humans in building materials, paper, and many other things, and for this function forests are invaluable. Demand for wood products is very high, and many different types of wood are used. Many food products are also found in forests, whether they are the plants themselves or the animals that eat them. Finally, the aesthetic qualities of forests generate a large tourism industry, as many people come from far away to visit the United States' national parks and forests.

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8.3 Teacher Content

The world's biomes are divided into five major groups: aquatic, desert, tundra, grasslands, and forests. *Forests* are usually defined as dense growths of trees, plants, and shrubs, covering a large area, and are often viewed as little more than a source of firewood, timber, and land – once they are cleared. But, forests are actually ecosystems that are home to a vast variety of both plant and animal species, and are vitally important for sustaining life on earth for all living things – human beings included. The economic value of a forest is measured not only in the amount of wood that one can harvest from it, but also by other factors such as the **biodiversity** and environmental **sustainability** that it provides.



Deforestation is a major issue facing the world today. It is a global issue but is sometimes thought to be a problem only in a **tropical** rainforest **biome**; however, it also occurs in temperate forests as well. Deforestation can be defined as the permanent removal of trees from an area. Cutting trees does not result in deforestation unless the land is converted to other uses. Examples of deforestation include removal of trees for agriculture or for residential/commercial development. This degradation may in extreme cases lead to desertification and critical loss of diversity. When we refer to deforestation, we are not referring to just tropical rainforests, but to **temperate** forests, and all other forest areas as well.

Although it is difficult to place a precise figure on the rate of deforestation, the United Nations' Food and Agriculture Organization (FAO) estimates that 53,000 square miles of tropical forests (rain forest and other) were destroyed each year during the 1980s.

Of this, they estimate that 21,000 square miles were deforested annually in South America, most of this in the Amazon Basin. Based on these estimates, an area of tropical forest large enough to cover North Carolina is deforested each year! Even so, the rates vary from region to region.

In Virginia, 15.8 million acres are considered to be forestland, a decline of 180,600 acres in the past decade but an increase of 1 million acres from the 14.8 million of the 1940s. Sixty-two percent of the state is forested.

Globally, the most common causes of deforestation are the clearing of land for ranching and agricultural purposes and urbanization, public and private development schemes such as building roads, mining, and oil drilling. In Virginia the most common cause of deforestation is clearing for residential/commercial development.

Clearing Land for Ranching, Agriculture, and Urbanization

This is commonplace in both developed and developing countries. In developing countries this often occurs due to a lack of well established property rights, which allows people to expand their property into forest areas where no one has claim to the land. Population growth and expansions of urban areas, due to industrialization and other forms of economic growth, increase the need for land and results in the clearing of forest land for buildings to provide housing and office space for growing cities. In the poorer regions of the world, the forest is cleared for subsistence farming to feed large families, but due to a lack of implementing sustainable methods (such as crop rotation, soil conservation and use of organic fertilizers to prevent nutrient exhaustion) the land quickly becomes exhausted and less

fertile, leading to lower crop yields and prompting them to clear more land for farming, eventually cutting down entire forests.

Public & Private Development Schemes

This trend is influenced by government policies. The economic value placed on forest land is often low and preservation is not promoted, so forests are cleared even when it would be more beneficial

to preserve them. In some countries, tax incentives encourage the clearance of forest for cattle and other farming activities because the tax paid by forest land owners is much higher than that paid by agricultural-land owners who pay lower taxes—giving forest land owners the perverse incentive to turn their land to agricultural-use land, even if the gains of that are lower, just to avoid paying higher taxes.



Extraction of Natural Resources

Activities such as oil drilling and mining are sometimes economically beneficial over the short term since they generate highly priced commodities. Those who mine or drill for oil are driven by the financial gains of their activities and can alter forest ecosystems.

In Virginia, the most significant factor in the loss of forests is urbanization and development. Since 1992, of the 615,000 acres of forest that have been lost, 62 percent were lost due to development and 37 percent to agricultural purposes. In addition, the percentage of forests in private ownership has decreased since 1992 while non-forestry corporations have increased ownership. Nevertheless, private individuals own more than 66 percent of forests in Virginia.

Most landowners and loggers in Virginia work to protect water quality through the implementation of **Best Management Practices (BMP)**. These are guidelines developed by the Virginia Department of Forestry. State agencies provide advice and assistance to foresters to help apply those practices. State and local governments sometimes provide incentives for those willing to conserve forest land and protect water quality.

A Look at History

European settlers arrived in the United States in the 1500s to find American Indians living almost everywhere they travelled in the southeastern US, and a landscape that was easily traversed by people on horseback. As compared to the limited species diversity of European forests at the time, the forests in the southeastern region of North America were highly diverse and composed of many species of pine, oak, and hickory as well as tulip tree and other species; oak, gum and cypress were formed in the bottomlands; and plum, mulberry, persimmon and other trees in agricultural areas. In the next 100 years, diseases brought over from Europe affected up to 90% of the Indian population, and many areas that were in agricultural production almost certainly were converting to forest land through the process called succession. After European settlement of the southern United States, there are three historic periods of land use and resource extraction that shaped the region's landscape and influenced its cultural history (The Southern Forest Resource Assessment October 2002).

The first of these was clearing of land for agricultural use, which began in the 17th century and reached a high point in the late 19th century due to an expansion of cotton production. The second

major period began in the early 20th century when the economic values of these forests expanded. Widespread tree harvest provided materials for timber production and ship masts. Over a 20-year period, southern timber stocks were depleted to the point where the region was considered “forest-resource poor” and the remaining soils were nutrient-poor.



The third period began around the time of the Great Depression when the unproductive forest lands were abandoned. Over the following 40-year span, southern forests experienced a period of regrowth. In 1905, the U.S. Forest Service was established in the Department of Agriculture under the leadership of chief forester Gifford Pinchot. At the same time, the timber land reserves, originally under control of the General Land Office in the Department of Interior, were transferred to the Forest Service, and renamed “National Forests.” Between 1905 and 1910, the number of forest reserves rose from 60 to 150 units and the number of acres included in the reserves expanded from 56 million to 172 million. Today, the national forest system includes 191 million acres managed by the Forest Service through development of fire policies, logging practices, wilderness designations and wildlife and watershed protection.

The U.S. Forest Service manages the National Forests under a multiple use policy, including timber, wildlife, recreation, water, and grazing. To manage for all of these uses, the Forest Service must keep the forests in a healthy, sustainable condition. Fire plays a key role in keeping the health of an ecosystem, especially in our forests. Forest ecosystems are linked with other life cycles – i.e. the carbon, nitrogen, and water cycles. For instance:

- **Carbon Cycle** – Forests have an extensive root biomass that holds soil together, therefore allowing for bacteria to respire and decompose organic matter. Plant life processes carbon dioxide via photosynthesis, converting it into oxygen so that other living things can breathe and continue living. This also prevents carbon dioxide from accumulating in the atmosphere and further increasing the current problem of global warming.
- **Nitrogen Cycle** – Forest trees absorb nitrates and use them, preventing the buildup of these nutrients, which can lead to eutrophication (see VI. Window into Air). Excess nitrates leach into our groundwater, making it unsafe for drinking (a big issue in developing countries where land is cleared constantly and there are very limited sources of clean water for everyday consumption).
- **Hydrological (Water) Cycle** – Forests regulate the amount of water absorbed by rivers, oceans, and streams by capturing water in their roots. This allows a certain amount of control over evaporation rates and precipitation, helping in the regulation of weather and climates. With continued deforestation, there would be excessive flooding as water enters various bodies of water without any restraint, at a continuous and increased rate.

Many people assume fire always has a detrimental effect on our forests. After a fire, a forest may look ugly and dead. Smokey Bear has always urged students to prevent forest fires. While this is true for some types of fires, which will be discussed later, some fire is necessary. People may not realize that it is a necessary natural force that must occur for the health of our forest. The public mainly hears about the high severity, damaging fires that affect private property. This is only one type of fire; there are other types that are important for the livelihood of an ecosystem.

There are three types of fire. The first type is a ground fire. A ground fire burns at the bottom of the forest and stays on the ground, even in the soil. This type does not cause a large threat to humans, but can be the most difficult to extinguish. If the soil burns for too long, it may become hydrophobic, which means it will not absorb water. The second type of fire is a surface fire. They burn in shrubs and other types of vegetation low to the ground. The third type of fire is a crown fire. These are the most dangerous fires, because they burn the tops of trees and cause the most damage.

Wildfires

Fires have been a natural occurrence in the environment since before humankind set foot in this country. During a dry season, lightning would strike and start a fire. Fires occurred often in some places, and less often in others. Many trees and wildlife species have adapted to this type of disturbance, and some even depend on it for regeneration (USFS, 2003). For example, some pine cones need fire to open and release seeds, thereby allowing regeneration to take place.

Humans have prevented and suppressed fire at a rate greater than the natural occurrence. This has caused a build up understories with large amounts of hazardous fuels. The understory includes all the vegetation in a forest under the dominant trees. Hazardous fuels include dead trees, fallen branches, vines, and smaller trees. Naturally occurring ground and surface fires kept these fuels to a minimum in the past. Crown fires did not happen as often because smaller fires prevented them from occurring. Once a ground or surface fire begins, it is more likely to become a crown fire because of the access to fuels (USFS, 2003).



In the past, forests burned frequently, and only the understory fuel would burn with little or no damage to the overstory. The overstory of a forest includes the tallest trees that create the canopy of the forest. Currently, the smaller understory trees present in these forests can act as “ladder” fuels, which allow the fire to move quickly into the crowns of the overstory, causing higher severity wildfires. They are called ladder fuels because the fire moves up them like a ladder, into the tops of the trees. These fuels are one of the four main factors that result in wildfires, others include: weather, terrain characteristics, and a lack of moisture. The abundance of fuel is the only manageable factor (USFS, 2003).



Forest managers have realized that fire is an essential element in forest ecology. Therefore, they manage forests in a way that brings fire back into the cycle. Prescribed burning is the main tool for this. Prescribed burning is done to mimic ground or surface fires that prevent the buildup of hazardous fuels. This type of fire does not harm the overstory. Essentially, fire is used to prevent fire. These fires are closely controlled to prevent spreading.

Prescribed burning is used in the George Washington-Jefferson National Forest of Virginia. Public and fire fighter safety are critical when performing a prescribed burn. They incorporate fire into the management plan because it is ecologically important, and the best available science is used. These management plans address public health and environmental needs and concerns (USFS, 2004).

Although Virginia generally does not experience the devastating crown fires experienced in the western U.S., wildfires do occur every year, and destroy about 8,000 to 10,000 acres of forest and grassland each year. There are many measures that can be used to help prevent wildfires. State and federal agencies administer some of these measures, but others depend on average people. The

number one cause of wildfires is open-air burning by people, and the government has enacted laws to cut down on these fires. Open burning is prohibited before 4:00 p.m. to ensure that the hottest part of the day has passed and that the winds have calmed. Also, fires that are burning must not be left unattended. No new fires may be started, nor fuel added to fires after midnight. These are just a few portions of the law. Failure to follow the law can result in a \$500 penalty, and perhaps the costs to put out the fire if it were to spread.

Arson, the intentional setting of fires, is another cause of wildfire. Anyone who suspects that an act of arson has occurred should report it to the police or the forest warden. There are also miscellaneous causes of wildfires. These can include houses, aircraft, and hot ashes. All hot ashes and charcoal should be disposed of in a metal container. They should be allowed to cool for 48 hours before they are dumped on the ground. The last cause of wildfires that we will discuss is campfires. Many think that this would be the largest cause of wildfires. This is not true however. Campfires only cause one percent of the total wildfires in Virginia. Though this number is low there are steps that can be taken to prevent campfires from spreading into wildfires. First, there should be a 10-foot safety circle around the fire. This area should not contain any leaves, pine needles, or any other flammable materials. A campfire should never be left unattended and an adult should “dead out” the fire with water before leaving the area.

Wildfires in Virginia do not always receive a lot of attention, but they destroy forests and decrease air and water quality. It is everyone’s responsibility to prevent wildfires by using common sense and following all forest laws and regulations.

Wildlife

Wildlife is a unique natural resource in North America. Unlike the trees, soils, minerals and water, wildlife is a public resource and cannot be held in private ownership without permission from the state or federal government. As a public resource its management and protection falls to the government agencies entrusted with its health. Since the majority of the species live on private land, everyone has a responsibility as a citizen to participate in the management process.

Virginia is home to many species of wildlife from the marine mammals and sea turtles that visit our coast to the freshwater mussels in southwest Virginia. Whitetail deer feed along the forest edges while the bald eagle flies overhead. Virginians and visitors to the state spend almost two billion dollars a year to enjoy the Commonwealth’s vast diversity of wildlife through many forms of wildlife recreation including wildlife watching, hunting and fishing.

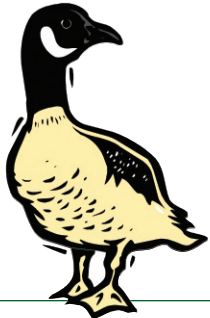
As land is developed for human uses, habitats may be destroyed or changed and some species may be forced out. Individuals able to relocate to nearby areas will move, although many perish if remaining habitats are at their carrying capacity. Others are adaptable and will continue to live in close association with humans. Animals on the move can create safety problems as they cross roadways or decide to move into attics and crawl spaces.



One species that has adapted to live with humans is the Virginia whitetail deer. At the time Jamestown was settled in 1607, whitetail deer were found in abundance with an estimated population of 400,000 in pre-colonial Virginia. This is only an estimate; the exact number will never be known. By the early 1900’s, excessive harvesting and destruction of habitat had reduced the herd to an estimated 25,000. One of the first duties of the newly formed Department of Game and Inland Fisheries (DGIF) was to

reestablish the deer herd. Efforts in restocking the western half of Virginia, effective wildlife management techniques and reforestation reversed the decline.

By 1988, the whitetail herd had grown to approximately 575,000 deer. In some counties, deer had reached the cultural carrying capacity (the numbers of animals' people are willing to tolerate). Concerns of deer feeding on crops and suburban landscapes led to changes in the hunting seasons and bag limits in order to increase the harvest of does in these areas and reduce the local population. The population of deer statewide is now estimated to be between 950,000 and 1,000,000. The DGIF gathers input from citizens in order to keep the herd within cultural carrying capacity of an individual local. For more information on Virginia's deer management plan visit the DGIF at http://www.dgif.virginia.gov/hunting/va_game_wildlife/index.html.



Learning from Mother Goose . . . ?

Unlike many other birds, Canada Geese require a "parent's" instruction in order to migrate. Migration is not an innate behavior for geese and cranes. Offspring must be taught to migrate or they will stay in place.

Unfortunately, an overpopulation of these large birds can lead to negative interactions with humans and airplanes. Aggressive geese, particularly mother's with young, can cause problems around golf courses and neighborhood parks.

Many citizens who enjoy hunting or fishing in the Commonwealth are willing to purchase a license each year for the opportunity. These recreational practices are closely regulated by government agencies, which strictly define what people are allowed to hunt or fish, who can do it, and when in the year they are permitted to. Wildlife recreation including hunting, fishing and wildlife watching bring millions of dollars of economic benefit to the state. The monies from the sale of licenses is used to manage all species of wildlife, including those not hunted or fished for such as songbirds, amphibians and small mammals. Virginia is home to over 100 endangered and threatened wildlife species, which also benefit from the license funds.

All species of wildlife are essential to the health of Virginia ecosystems. Bats eat millions of flying insects every night, many of these insects feed on crops. Some species of insects are important pollinators for the agricultural industry, including honey bees, butterflies, moths and even some species of wasps. Hawks, owls, foxes and snakes keep the rodent population under control, and larger predators keep populations of other animals, such as deer, in check.

Although all wildlife is important, some species can cause property damage. Large flocks of non-migratory resident Canada Geese graze on golf courses, in the medium strips of highways and airport runways and around urban lakes. Large birds can cause accidents by wandering into a major highway or flying into a jet plane. People also have to deal with their droppings on their property, and the excess nutrient load caused by runoff of the droppings into local water sources creates additional problems in the treatment of drinking water, as well as increasing the water quality problems in the Chesapeake Bay. Other wildlife that cause economic damage can be dealt with by altering the access to the site, or changing or removing one of the habitat components. For example, since geese are grazers and prefer grassy areas for feeding, altering the habitat to make it unattractive to the geese by planting low growing woody perennials could prevent their presence. Wildlife is protected by state and federal law and therefore citizens cannot kill or trap and remove many species without a permit from the state or federal government. With geese, the DGIF and the U.S. Fish and Wildlife Service, when possible, try to deal with over abundance through special recreational hunting seasons. The establishment of special hunting seasons has decreased the goose population since it peaked in the 1990s. When hunting is not an option such as at an airport, the U.S. Department of Agriculture may be called in to help reduce the population. Below are some problems caused by wildlife and possible solutions. Additional information may be found at http://www.dgif.virginia.gov/wildlife/nuisance_wildlife.html.

- Bears may raid bee hives placed in fields and orchards for pollination and honey production. Placing an electric fence around the hives will usually solve the problem.

- Deer feeding on landscape plants in urban and suburban neighborhoods. Planting less desirable plants or fencing the area may work to protect plants, although no method is 100% effective when there is a large number of deer.
- Raccoons in trash cans. Keeping trash cans in a garage or shed until pick-up day is the best solution. If trash can not be kept indoors, use bungee cords to hold lid on tight to keep raccoons from opening or tipping over trash can.
- Blue Herons eating fish from a backyard pond. Plant bushes around the pond so the heron cannot step into the pond or drape a net over the pond.
- Pigeons nesting or roosting on buildings. Ledges may be altered so the birds cannot secure a firm footing by placing a piece of metal at a 45 or greater degree angle. Pigeons are not native and are not protected by state or federal law.

Native species seldom cause detrimental economic impact because healthy natural systems tend to control populations. Major economic impact by wildlife is more often from introduced species, which are referred to as **invasive**. A recent example of an invasive species is the zebra mussel. These small thumbnail size mussels were accidentally introduced into the Great Lakes in the 1980s and are slowly spreading across the country. These mussels out compete native species for food and substrate to on which to grow. In addition, because of the clumping nature of the zebra mussel, they clog water intake valves at industrial sites and water treatment facilities, clog motors on boats, and destroy swimming beaches.

Congress, state and local governments are looking at ways to prevent additional non-native species from becoming established in the United States. Other introduced wildlife species that have cost billions of dollars over the years include the European Starling, the Sea Lamprey, the English Sparrow and the Nutria. For additional information on invasive aquatic species visit www.protectyourwaters.net.

Building Backyard Habitats



The key to managing wildlife is habitat management. The combination of food, water, shelter and space in a suitable arrangement is called habitat. Ecosystems are made up of many individual habitats and no animal can thrive without its own habitat. Individuals can help manage the Commonwealth's vast variety of wildlife by developing and improving habitats on their school grounds or in their backyards. The saying goes "If you build it they will come" is particularly true when it comes to wildlife, however anyone considering constructing a habitat needs to properly plan for what may come.

To attract wildlife to an area, you need a plan. What species are you trying to attract? What other species also share the same habitat components? For example, hummingbirds, butterflies and honey bees require large amounts of nectar and blooming flowers will attract all three. If you have allergies to bees, you may not want to attract butterflies and hummingbirds. Feeding songbirds without adequate shelter to escape predators may actually be feeding a hawk. This is the natural order of life and is often the best way to view food chains and interdependence between organisms.

To construct a habitat, begin with an inventory of plants including all the trees, shrubs and herbaceous plants. Which plants serve as food and or cover? Bluebirds need both open spaces to hunt insects in

and a tree cavity or box for a nest. Once the inventory is complete and you have decided what species may already be living in the area, you need to make decisions based on what you want to have in the area and their habitat requirements. You may find you have too many trees and must remove some to enhance sunlight. Plant diversity is also important: do you have different varieties as well as different sizes? Cardinals prefer to nest in dense shrubs about 5 feet high, robins prefer a fork in a tree or branch about 15 feet up.

Don't forget water, essential for all life. Is water available in a natural stream or pool? If not, how are you going to provide water? Clean and fresh water is important for many species. Water can be provided in a number of ways, including bird baths and backyard ponds. To prevent the water from becoming a stagnant mosquito habitat it must be changed or kept moving. Water is as equally important in the winter as it is in the summer months.

It is important to recognize that properly designed habitats for a few species often become mini ecosystems attracting many other species you may not have thought of. Mice are attracted to bird seeds and in turn attract snakes and hawks. Raccoons find the corn you put out for squirrels equally appetizing. Even though you have attracted these animals to your yard and supplied all their needs, they are still wild and will defend themselves if threatened. Never attempt to pick up or handle a wild animal. Some carry diseases; some will deliver a nasty bite. It is always best to enjoy wildlife at a distance. It is a great learning experience and enjoyable way to spend a day.

Additional information on attracting wildlife can be found on several websites. Native plants that provide food and cover can be found at local nurseries. Certification for your habitat is available from both the Virginia DGIF, www.dgif.virginia.gov and the National Wildlife Federation at www.nwf.org.



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8.4 Materials List

8 – 1 *Identify Characteristics of Different Biomes*

- Activity sheet
- Internet access

8 – 2 *Leaf/Tree Identification*

- Activity sheet
- Clipboard
- Leaf identification cards
- Pencils

8 – 3 *Forest Hike – Identification of Zones of Forest*

- Clipboard
- Pencils

8 – 4 *Tree and Wood Products Scavenger Hunt*

- Pencils

8 – 5 *Wildfire Survey*

- Pencils

8 – 6 *Wildfire Simulation*

- Pencils

8 – 7 *Observing Wildlife in an Urban Setting*

- Pencils

8 – 8 *Building a Birdhouse*

- Wooden boards
- 5d nails
- Hammer
- Drill
- Saw
- Paintbrushes
- Exterior paint
- Glue gun
- Single-strand wire

Important Safety Information

When taking students into a forest, remember to have them continue to follow the path set by the teacher. Have the students wear sneakers, long socks, and long pants, and have them apply insect repellent before doing labs that involve going into a forest. After the activities, remind the students to thoroughly clean themselves off when they get home, and to do complete checks for ticks, particularly on their legs, arms, and warm areas on their bodies.

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8.5 Activities

8 – 1 *Identify Characteristics of Different Biomes*

Students are asked to go to a website to learn about the three main forest biomes. In a worksheet, they will list different characteristics they learned about the three biomes.

8 – 2 *Leaf/Tree Identification*

Tree identification will occur through observation.

8 – 3 *Forest Hike – Identification of Zones of Forest*

Students will identify the levels of a forest; identify signs of human impact and observe how the ecosystem adjusts.

8 – 4 *Tree and Wood Products Scavenger Hunt*

Many items used in the home every day originate from trees or wood products. Students will identify these products in their own homes.

8 – 5 *Wildfire Survey*

Students are asked what their opinions are on stopping forest fires and also to ask fellow students.

8 – 6 *Wildfire Simulation*

Students will go to a website, where they will set up a wildfire simulation which allows them to change the condition of moisture, wind speed and direction, and type of undergrowth.

8 – 7 *Observing Wildlife in an Urban Setting*

Wildlife does not only appear in forests but also in the suburbs and surrounding areas. Students will observe wildlife in their area.

8 – 8 *Building a Birdhouse*

Birdhouses are built with directions found online.

8 – 9 *Benefits & Costs: Paper vs. Plastic?*

Students will compare the costs and benefits of paper vs. plastic bags.

Important Safety Information

When taking students into a forest, remember to have them continue to follow the path set by the teacher. Have the students wear sneakers, long socks, and long pants, and have them apply insect repellent before doing labs that involve going into a forest. After the activities, remind the students to thoroughly clean themselves off when they get home, and to do complete checks for ticks, particularly on their legs, arms, and warm areas on their bodies.

Forest Characteristics**Purpose**

Identify characteristics of the three main forest biomes.

Procedure

Go to the following website: <http://www.ucmp.berkeley.edu/glossary/gloss5/biome>

Use information from the website to describe characteristics of each of the following biomes.

Characteristic	Tropical	Temperate	Boreal
Temperature	20 to 25 C Little variation during year	-30 to 30 C Well defined seasons	Very low Short moderately warm summers Long, cold, dry winters
Precipitation	Evenly distributed throughout year Annual rainfall 200 cm	Evenly distributed 75-150 cm	Primarily snow 40-100 cm
Soil	Nutrient poor, acidic	Fertile with decaying litter	Thin, nutrient poor, acidic
Canopy	Multilayered, continuous, little light penetration	Moderately dense, well developed understory	Low light penetration, limited understory
Flora (Plants)	Highly diverse, mostly evergreen, orchids, ferns, mosses, palms	3-4 tree species per square km, deciduous	Mostly evergreen conifers
Animals (Fauna)	Numerous birds, bats, small mammals, insects	Small mammals, deer, wolves, bears	Small mammals, wolves, deer, weasels, fox

Forest Characteristics**Purpose**

Identify characteristics of the three main forest biomes.

Procedure

Go to the following website: <http://www.ucmp.berkeley.edu/glossary/gloss5/biome>
Use information from the website to describe characteristics of each of the following biomes.

<i>Characteristic</i>	Tropical	Temperate	Boreal
Temperature			
Precipitation			
Soil			
Canopy			
Flora (Plants)			
Animals (Fauna)			

8 – 2 Leaf/Tree Identification

Purpose

Identification of trees by leaf shape

Materials Needed

- clipboard
- pencils
- data sheets for each student
- leaf identification chart

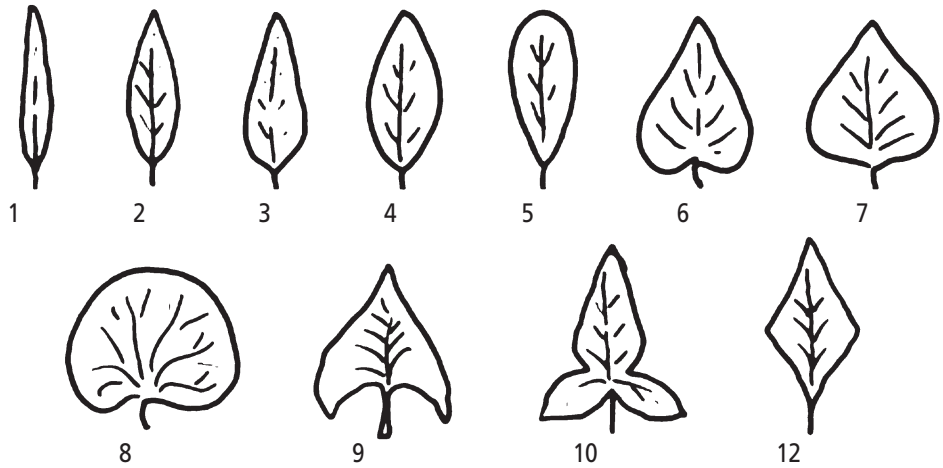
Procedure

Sketch the shape of each leaf on your data chart. Using the leaf identification chart on the next page, identify as many trees as you can. *Do not pick leaves!*

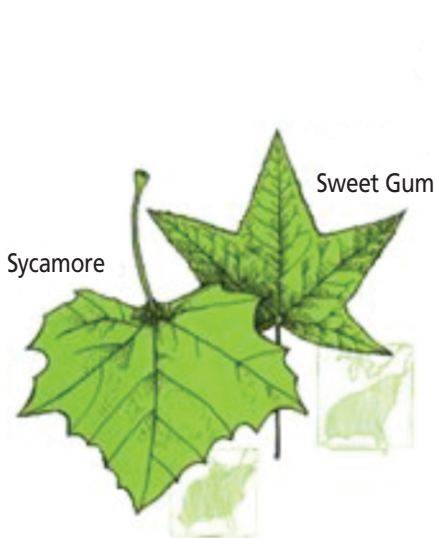
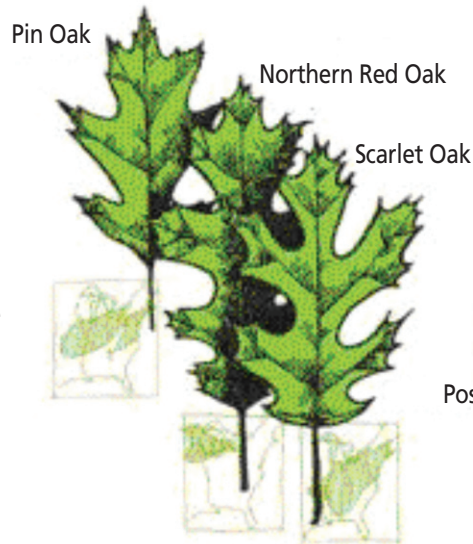
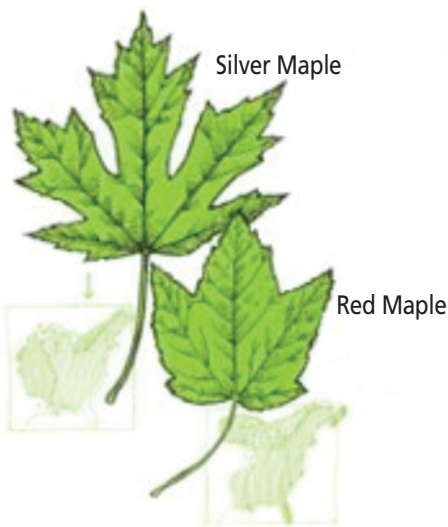


**Leaf
Identification
Chart**

8 – 2 Leaf/Tree Identification



- | | | |
|--------------------|------------------|-----------------|
| 1. Needle-shaped | 2. Oblong | 3. Lance-shaped |
| 4. Ovate | 5. Spoon-shaped | 6. Heart-shaped |
| 7. Triangle | 8. Kidney-shaped | 9. Arrow-shaped |
| 10. Halberd-shaped | 11. Wedge-shaped | |



Scientific Names

- | | |
|--------------------|--------------------------------|
| • Silver Maple | <i>Acer saccharinum</i> |
| • Red Maple | <i>Acer rubrum</i> |
| • Pin Oak | <i>Quercus palustri</i> |
| • Northern Red Oak | <i>Quercus rubra</i> |
| • Scarlet Oak | <i>Quercus coccinea</i> |
| • Post Oak | <i>Quercus stellata</i> |
| • White Oak | <i>Quercus alba</i> |
| • Chestnut Oak | <i>Quercus prinus</i> |
| • Sycamore | <i>Platanus occidentalis</i> |
| • Sweet Gum | <i>Liquidambar styraciflua</i> |
| • Black Walnut | <i>Juglans nigra</i> |
| • Pignut Hickory | <i>Carya glabra</i> |

8 – 2 Leaf/Tree Identification

Data Chart

Sketch the shape of each leaf on your data chart. Using the leaf identification chart on the previous page, identify as many trees as you can. *Do not pick leaves!*

Sketch of Leaf	Type of Tree
<div></div>	<div></div>

Sketch of Leaf	Type of Tree
<div></div>	<div></div>

8 – 3 Forest Hike – Identification of Zones of Forest

Ecosystem Observation

Purpose

Identification of levels of forest. Identify signs of human impact.

**Materials
Needed**

- Clipboard
- Pencils

Procedure

Walk the trail following instructions from your teacher. Make sure to stay on the trail only. Do not pick any plants or disturb any wildlife. Record your observations below.

Activity

Look for:	What I saw:
Habitat – what are the types of habitat that you observe (underbrush, water, trees, etc. . . .)?	
What types of plants did you observe?	
What types of wildlife did you observe – either by signs or tracks or by seeing it?	
Were there any non-living factors such as rocks or water in the area?	
Did you see any signs of human impact in the area?	

8 – 4 Tree and Wood Products Scavenger Hunt

Wood Products

Purpose

To identify items in our homes from trees or wood products.

Procedure

Use the checklist to see how many of these products you can find at home or at school!

- | | | |
|-----------------------------------------|----------------------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> Apples | <input type="checkbox"/> Almonds | <input type="checkbox"/> Aspirin |
| <input type="checkbox"/> Adhesives | <input type="checkbox"/> Alcohol | <input type="checkbox"/> Artificial Flavoring |
| <input type="checkbox"/> Atlas | <input type="checkbox"/> Axe | <input type="checkbox"/> Baby Food |
| <input type="checkbox"/> Bags | <input type="checkbox"/> Baseball Bats | <input type="checkbox"/> Boat |
| <input type="checkbox"/> Books | <input type="checkbox"/> Buttons | <input type="checkbox"/> Calendar |
| <input type="checkbox"/> Candy Wrapper | <input type="checkbox"/> Canoe | <input type="checkbox"/> Cards |
| <input type="checkbox"/> Cellophane | <input type="checkbox"/> Ceramics | <input type="checkbox"/> Charcoal |
| <input type="checkbox"/> Chewing Gum | <input type="checkbox"/> Cider | <input type="checkbox"/> Clocks |
| <input type="checkbox"/> Cork | <input type="checkbox"/> Cosmetics | <input type="checkbox"/> Cribs |
| <input type="checkbox"/> Decoy | <input type="checkbox"/> Desk | <input type="checkbox"/> Diaper |
| <input type="checkbox"/> Door | <input type="checkbox"/> Dry Wall | <input type="checkbox"/> Explosives |
| <input type="checkbox"/> Fertilizer | <input type="checkbox"/> Fingernail Polish Remover | <input type="checkbox"/> Fire Ladder |
| <input type="checkbox"/> Flag pole | <input type="checkbox"/> Flypaper | <input type="checkbox"/> Fruit |
| <input type="checkbox"/> Fuel | <input type="checkbox"/> Fungicide | <input type="checkbox"/> Furniture |
| <input type="checkbox"/> Guitar | <input type="checkbox"/> Gummed Tape | <input type="checkbox"/> Gunstocks |
| <input type="checkbox"/> Hairspray | <input type="checkbox"/> Handles | <input type="checkbox"/> Hockey Stick |
| <input type="checkbox"/> Insulation | <input type="checkbox"/> Kennels | <input type="checkbox"/> Lumber |
| <input type="checkbox"/> Laxatives | <input type="checkbox"/> Magazine | <input type="checkbox"/> Maps |
| <input type="checkbox"/> Medicine | <input type="checkbox"/> Menthol | <input type="checkbox"/> Milk Container |
| <input type="checkbox"/> Movies | <input type="checkbox"/> Mulch | <input type="checkbox"/> Nuts |
| <input type="checkbox"/> Oars | <input type="checkbox"/> Oxygen | <input type="checkbox"/> Pallets |
| <input type="checkbox"/> Particle Board | <input type="checkbox"/> Pencils | <input type="checkbox"/> Peppermints |
| <input type="checkbox"/> Photo film | <input type="checkbox"/> Ping Pong Balls | <input type="checkbox"/> Plates |
| <input type="checkbox"/> Plywood | <input type="checkbox"/> Racks | <input type="checkbox"/> Rafts |
| <input type="checkbox"/> Railroad Ties | <input type="checkbox"/> Rakes | <input type="checkbox"/> Rayon |
| <input type="checkbox"/> Roofs | <input type="checkbox"/> Seesaw | <input type="checkbox"/> Shampoo |
| <input type="checkbox"/> Skis | <input type="checkbox"/> Soap | <input type="checkbox"/> Sponges |
| <input type="checkbox"/> Stamps | <input type="checkbox"/> Swings | <input type="checkbox"/> Tax Forms |
| <input type="checkbox"/> Tires | <input type="checkbox"/> Toothpaste | <input type="checkbox"/> Varnish |
| <input type="checkbox"/> Vitamins | <input type="checkbox"/> Waxes | <input type="checkbox"/> Walnuts |

8 – 5 Wildfire Survey

Wildfire Benefits and Costs

Activity

Many people have misconceptions about forest fires. Most everyone knows Smokey the Bear's expression – "Only YOU can prevent forest fires." But is it true that forest fires should *always* be prevented? Do a survey to find out what your fellow students think.

A questionnaire should be written so that questions are easy to understand and require yes/no or simple answers. Here are a few examples you could use:

- Are all wildfires bad?
- Do you think wildfires could be beneficial?
- Which causes more wildfires – lightning or humans?
- Should fires be allowed to burn if people or homes are not in danger?

Write the question you are going to use in your survey.

Do you think you need to keep track of male and females separately? Do you think you want to keep track of the ages of your respondents?

How will you keep track of the responses to your survey question?

Now tally your results and compare your results with the rest of the class.

What is the attitude about forest fires from your respondents – were they positive or negative?

Did you notice a difference in attitudes based on gender (male/female) or age?

Do you think that learning about the ecology of forests would make a difference in attitudes?

Procedure

Go to the following website: <http://www.pbs.org/wgbh/nova/fire/simulation.html>

This site will allow you to set the condition of moisture, wind speed, and direction, and type of undergrowth. It also allows you to use the techniques of firefighters and build firelines and backfires to control the fire.

Try the simulation several times, changing the conditions each time.

What conditions or techniques caused the fire to burn more rapidly?

Answer: Increasing wind speed, and decreasing percent of moisture causes fire to burn more rapidly.

What conditions or techniques caused the fire to burn more slowly?

Answer: Decreasing wind speed and increasing moisture causes fire to burn more slowly.

Describe what techniques you might use to control a fire burning out of control.

Answer: Some techniques might include clearing a fire line or setting a backfire.

8 – 6 Wildfire Simulation

Procedure

Go to the following website: <http://www.pbs.org/wgbh/nova/fire/simulation.html>

This site will allow you to set the condition of moisture, wind speed, and direction, and type of undergrowth. It also allows you to use the techniques of firefighters and build firelines and backfires to control the fire.

Try the simulation several times, changing the conditions each time.

What conditions or techniques caused the fire to burn more rapidly?

What conditions or techniques caused the fire to burn more slowly?

Describe what techniques you might use to control a fire burning out of control.

8 – 7 Observing Wildlife in an Urban Setting

Procedure

Forests aren't the only places to observe wildlife. If you live in an urban or suburban area you can also observe wildlife. Choose one of the following animals and over the next few days keep your eyes open!

Groundhog	Grey Squirrel	Opossum	House Sparrow
Pigeon	Starling	Skunk (<i>be careful!</i>)	Whitetail Deer

Remember – you are to observe, not to touch or disturb the habitat in any way.

What did you observe?

Activity

Look for:	What I saw:
Habitat – what was the type of habitat that you observed (underbrush, water, trees, etc. . . .)?	
What time of day or night did you see this animal?	
Where did you observe this animal?	
Did you observe its eating habits?	
Why do you think this animal survives so close to humans?	

8 – 8 *Building a Bluebird House*

Plans for birdhouse can be found at: <http://www.byggpub.com/bluebird/>

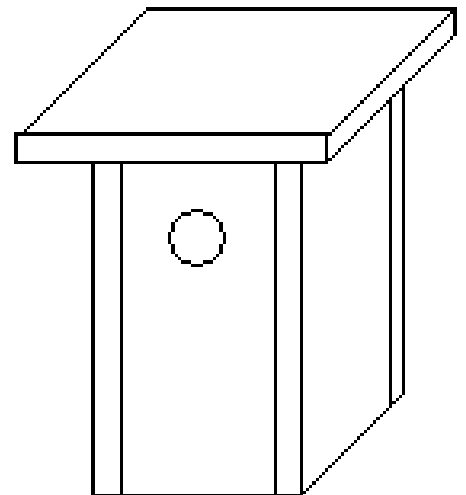
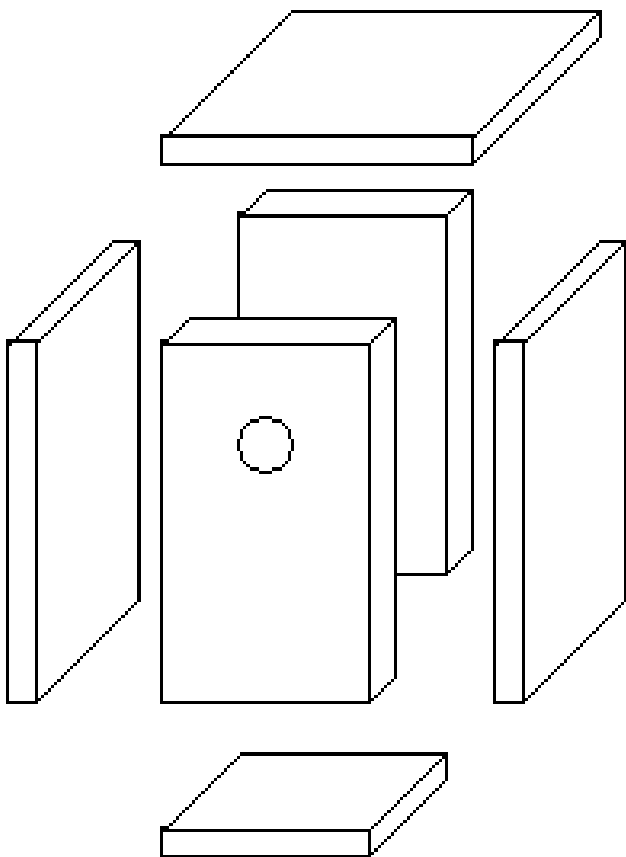
Materials Needed

Go to your neighborhood lumberyard or home improvement center and buy the following items:

- 1 x 6 (one by six) boards (4.5 linear feet per house)
- 1 x 8 (one by eight) boards (8 linear inches per house)
- A box of 5d (5 penny, or 1-3/4") nails. You want to buy normal nails with heads, not finishing nails.
- Some white, brown, or green exterior paint, preferably latex so that it washes up with water.
- One cheap paintbrush for each kit
- Heavy single-strand wire

You will also need:

- A 1.5" hole saw for your drill
- A 1/16" and 1/8" drill bit
- A drill
- A circular or hand saw
- A hot glue gun and some glue
- A hammer



8 – 9 *Benefits and Costs: Paper vs. Plastic?*

So you want to help the environment? Which should you choose, paper or plastic?

Background

Let's take a look at how each type of bag is made. Since plastic bags are made from petroleum, a non-renewable resource, and paper bags are made from wood, a renewable resource, paper bags are better in that aspect. So paper is better, right? Not necessarily. It can take more than four times as much energy to produce a paper bag as it does to make a plastic bag (ReusableBags.com). This is because an average plastic bag requires 594 BTUs of energy to produce, whereas an average paper bag requires 2,511 BTUs. It is also important to note that paper bags have a major impact on trees. Fourteen million trees were chopped down to make the 10 billion paper bags that were used in the United States in 1999 (ReusableBags.com). This is doubly bad for global warming since forests, which absorb greenhouse gases, are cut down to produce the bags and then the manufacturing process produces more greenhouse gases.

Plastic bags carry 80 percent of the nation's groceries (Sierra Club). It is important to note that since baggers pack fewer items in plastic bags than they do in paper bags, there is not an even trade between paper and plastic. It is estimated that the ratio of plastic to paper is between 1.5:1 and 2:1 (Grass Roots Recycling Network).

Though paper bags degrade faster than plastic in landfills, neither degrades fast enough to extend the lives of landfills in the United States, according to the University of Arizona Garbage Project (Film & Bag Federation). Also, the lack of oxygen necessary for the process of degradation makes paper bags in landfills difficult to break down. That having been said, plastic bags generate 80% less solid waste than their paper counterparts, using far less room in landfills. Even when taking into account that more plastic bags are used for the same amount of groceries packed into paper bags, plastic bags still take up less room in landfills (Brower, 1). However, even if doesn't practically matter that they can take hundreds of years to break down, it does matter that as they break down, plastic bags release harmful chemicals into the water and soil (Ives, 1). In addition, plastic bags floating in the ocean can cause wildlife to choke. Plastic bags are not all bad, though. Since they require 40 percent less energy to produce than paper bags and cause 70 percent less air pollution and release up to 94 percent less waste into the water, plastic bags could be friendlier to the environment (Ives, 2). Plastic bag production is improving. It takes 30 percent less material to produce plastic bags today than it did five years ago (Film & Bag Federation).

What about recycling our grocery bags? Plastic is easier to recycle. It takes 91 percent less energy to recycle a pound of plastic bags than it does to recycle a pound of paper bags (ReusableBags.com). But plastic bags are recycled less frequently. About 10-15 percent of paper bags are recycled, but only 1-3 percent of plastic bags are recycled. Although paper bags are recycled more often, each new paper bag is manufactured from mostly non-recycled pulp for better strength and elasticity.

So if recycling is not the answer, what about reusable bags? Taking a canvas bag to the grocery store and packing your groceries in it can save the use of many bags, but many consumers don't find it to be a convenient option due to the amount of groceries they buy at one time. What about reusing the paper or plastic bags in our own homes? Instead of throwing out your grocery bags, they can be reused as trash bags in your home. Paper bags are large enough to line some kitchen trash cans. Plastic bags make liners for small wastebaskets throughout the home. Also, plastic bags make packaging material for shipping items or protecting breakables when moving. Reusing your bags can make a difference. Reusing or recycling one ton of paper bags saves three cubic meters of space in landfills and saves 13-17 trees, and reusing or recycling one ton of plastic bags saves the equivalent energy of 11 barrels of oil (Sierra Club). These numbers indicate that whichever you choose, paper or plastic, making an effort to reuse or recycle the bags can make the biggest difference of all to the environment.

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